

# Barley and Adjuncts

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## Barley - 2 species

Hordeum Vulgare - 6-rowed barley

Hordeum Distichon - 2-rowed barley

## Winter vs. Spring Barleys

Winter - planted in September, harvested in July (11 months) → Requires Vernalization

Spring - planted in March, harvested in August (6 months)

\* Winter can be provided to maltsters sooner

\* Winter said to have higher yields per hectare, more sensitive to environment

\* Analysis of two types indicates not much composition difference.

## Barley Uses

• Baked goods

• Whiskey

• Growth medium

• Beer (malting barley)

• Feed

graded: 1 - 9 (worst/Best)

• yield

• disease resistance

• malting quality

## Production - Global 135 million tons

↳ 21 million for malting

↳ 17 million

94% - Beer

4% - Distilling

2% - Vinegar

## A Grain of Barley

Husk - (10-12%)

Pericarp - (2-3%)

Testa -

Aleurone - (4-5%)

Starchy Endosperm - (77-82%)

Embryo - (2-3%)

]- 97%

]- 3%

\* Dry weight

(moisture content in field - 15%)

Husk • Filtration in mash tun

- Indicator of grain health

- Damage → embryo damage or disease

Pericarp - Fruit wall of grain, barrier between environment & Aleurone layer.

- Cereals are fruits, not seeds
- Partial crush allows for enhancement of modification  
↳ Gibberellic Acid

Testa - 2 lipid layers (hydrophobicity)

Aleurone Layer - Surrounds Starchy Endosperm

- During Malting, this layer forms enzymes that unlock endosperm
- $\alpha$ -amylase, limit dextrinase, endoproteases, xylanases?
- G.A. produced by embryo during germination

Starchy Endosperm

70%  $\beta$ -glucans

20% pentosans

10% Proteins

mealy - more starch content vs Steely grain (Malts faster)

Steely - more proteins, harder endosperm

Embryo - germination center

65-70% - starch

30-35% - proteins

Absorbs moisture → 60% of moisture in barley is contained in embryo

Synthesizes G.A. → transported via aleurone layer around endosperm

## Most commonly used Adjuncts

Corn - 46%  
Rice - 31%  
Sugars/syrups - 22%

### Others

Sorghum/Millet  
Refined Corn Starch  
Wheat  
Cane/beet Sugar  
Rye  
Oats  
Potatoes

### Corn (Grits)

- dry milling of yellow corn
- higher levels of protein/fat
- up to 20% malt bill replacement

Extract :	78 - 83.2 %
Protein :	8.5 - 9.5 %
Fat/oil :	0.1 - 1.1 %

### Rice

- more expensive than rice
- By-product of rice industry.
  - kernels fractured during dehulling = Broken
  - up to 30% Broken → Brewing
- Lower oil content vs Corn
- must be boiled to gelatinize starch
- up to 20% malt bill replacement

Extract :	80.5 - 83.8 %
P :	5.4 - 7.5 %
F/O :	0.2 - 1.1 %

### Sorghum - (Millet)

- Africa & Central America
  - ↳ 100% millet beers: Billi Billi, Bantu beer, Dolo
- up to 45% malt bill replacement

E :	81 - 82 %
P :	8.7 - 10.4 %
F/O :	0.5 - 0.65 %

### Refined Corn Starch

- Very fine, pure starch
- Difficult to handle, process (sticking)
- Expensive

E :	90.6 - 98.3 %
P :	0.4 %
F/O :	0.4 %

## Wheat Starch

- Similar to Corn Starch

E:	86.5 - 95.2 %
P:	0.2 %
F/O:	0.4 %

## Torried Cereals

- Cereals heated to  $260^{\circ}\text{C}$  → Grains popped → Renders grain pre-gelatinized
- Grain can be used "As is"

	Wheat	Barley
E:	74.4	67.9
P:	12.2	13.5
F/O:	1.0	1.5

## Liquid Adjuncts

Sugar Cane → Sucrose

Corn, Wheat, → Dextrose (Glucose)

## Profiles

	1st gen	2nd gen	3rd gen	Wort From Traditional Process
Dextrose	65	40	5	8
Maltose	10	28	55	54
Malt-3	5	12	20	15
Dextrins	20	20	20	23

1st generation - Acid Conversion (HCl)

2nd generation - Acid/Enzymes

3rd generation - Multi Enzymes

→ Component charts B.S.P.  
Knevel